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PHYSICAL TRAINING PROGRAM GUIDELINES FOR U.S. NAVY RECRUITS: PREPARING RECRUITS FOR BATTLE STATIONS

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**Physical Training Program Guidelines
for U.S. Navy Recruits:
Preparing Recruits for Battle Stations**

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Summary

Problem. Recruits at the Naval Recruit Training Center (RTC), Great Lakes, are required to complete an 8-week course of Basic Training prior to assignment to specialized schools. The goal of Basic Training is to prepare recruits for shipboard duty. One way this is accomplished is through a program of physical conditioning designed to increase individual physical fitness levels, and to prepare the recruit for the final Physical Readiness Test (PRT) and Battle Stations. Preparing recruits to meet these objectives is the responsibility of the Recruit Division Commander (RDC). Meeting the goals of Basic Training is accomplished by providing each recruit with a comprehensive program of physical conditioning. This program is designed to (a) increase aerobic endurance, (b) increase muscular strength and power, (c) increase flexibility, and (d) decrease the incidence of musculoskeletal injuries. The successful execution of the physical conditioning program will increase recruit physical fitness, prepare recruits for Battle Stations, and increase Basic Training graduation rates.

Naval Health Research Center (NHRC) investigators, working in conjunction with RTC Great Lakes personnel, previously formulated guidelines for developing recruit physical fitness. These guidelines outlined the general principles of physical conditioning (i.e., total body fitness, balanced training, gradual overload, specificity of training, and injury prevention). These guidelines also provided physical training modules for aerobic conditioning, muscle and strength conditioning, and low-intensity exercise and training. However, new requirements have been implemented to increase the physical fitness and readiness of recruits. These requirements include (a) incorporation of Battle Stations into the final evaluation of recruits, (b) a directive instructing RDCs to assess the physical rigor of the training program to determine if the program is "too easy," and (c) a directive instructing RDCs to ensure that the physical conditioning program for women is sufficient to prepare them for successful completion of the final PRT and Battle Stations. It was not within NHRC's purview to make recommendations to change Battle Stations, and NHRC was required to incorporate six physical training sessions per week. Therefore, these new requirements necessitate modification and revision of existing physical conditioning guidelines.

Objectives. The objective of this work was to modify and revise the existing physical conditioning guidelines and training schedules used at RTC Great Lakes. These revisions will

better prepare all recruits to pass the final PRT and Battle Stations and for the rigor of the physical conditioning program.

Approach. Revisions to the existing physical conditioning guidelines were accomplished through (a) a review of the physical rigor of the existing physical conditioning curriculum, (b) addition of new concepts of injury prevention to reduce the incidence of musculoskeletal injuries, and (c) incorporation of training procedures and skill activities sufficient to prepare all recruits for successful completion of Battle Stations.

Results. The existing physical conditioning guidelines were revised to better prepare and ensure successful graduation of U.S. Navy recruits from Basic Training. The revised guidelines (see Chapter 2, Figure 1) emphasize the use of aerobic endurance training as a way to increase the intensity of the physical conditioning program to ensure the rigor of the overall training program, and they expand and apply the concept of “specificity of training” in the preparation of recruits for Battle Stations. These guidelines also progressively increase the duration and intensity of physical activity as a training method to prevent and reduce musculoskeletal injuries. Chapter 2 describes the five Modules which incorporate these new requirements.

Conclusion. A revised physical conditioning program has been developed targeting the needs of the U.S. Navy recruit population. The revised guidelines are designed to increase the aerobic endurance, muscular strength and power, and flexibility of males and females during the course of Basic Training at RTC Great Lakes. Special emphasis is placed on ensuring the physical rigor of the overall training program and preparing recruits for successful completion of Battle Stations.

Chapter 1. Introduction

The purpose of this manual is to provide recommended physical training guidelines for Naval Recruit training. Naval Health Research Center (NHRC) investigators, working in conjunction with RTC Great Lakes personnel, previously formulated guidelines for developing recruit physical fitness. These guidelines outlined the general principles of physical conditioning (i.e., total body fitness, balanced training, gradual overload, specificity of training, and injury prevention). These guidelines also provided physical training modules for aerobic conditioning, muscle and strength conditioning, and low-intensity exercise and training. However, new requirements have been implemented to increase the physical fitness and readiness of recruits. These requirements include (a) incorporation of Battle Stations into the final evaluation of recruits, (b) a directive instructing RDCs to assess the physical rigor of the training program to determine if the program is "too easy," and (c) a directive instructing RDCs to ensure that the physical conditioning program for women is sufficient to prepare them for successful completion of the final PRT and Battle Stations.

Recruit Physical Training and Battle Stations

All naval recruits must complete a course in Basic Training prior to attending specialized training schools. The goal of Basic Training is to prepare recruits for shipboard duty by increasing their physical fitness. One way this is accomplished is through the implementation of a program of physical conditioning to prepare them for the final Physical Readiness Test (PRT) and Battle Stations. The objectives of the program are to (a) increase aerobic endurance, (b) increase muscular strength and power, (c) increase flexibility, and (d) decrease the incidence of musculoskeletal injuries. It is the responsibility of the Recruit Division Commander (RDC) to provide recruits with a physical conditioning program. Understanding the concepts and principles of physical conditioning will allow the RDC to better develop and execute the physical conditioning program. It was not within NHRC's purview to make recommendations to change Battle Stations, and NHRC was required to incorporate six physical training sessions per week. Therefore, these new requirements necessitate modification and revision of existing physical conditioning guidelines.

Development of Battle Stations began in March 1997 and was modeled after the United States Marine Corps' "Crucible." Battle Stations began July 30, 1997 with 8 stations starting at

any time during the evening. Currently Battle Stations consists of 12 stations, with a plan to increase to 18 stations. Almost 54,000 recruits complete Battle Stations each year.

Battle Stations, which is executed in the 7th week of the 8 week recruit training schedule, has been designed to test the basic warrior attribute of sacrifice, dedication, teamwork and endurance in each recruit through the practical application of basic Navy skills and core values learned during recruit training. It is the culmination of the recruit physical training program and was designed to take into account what it means to be a Sailor. It is regarded as one of the most important modifications the Navy has introduced to boot camp in the last decade.

Battle Stations helps Sailors test their stamina and team work skills so that they know they can handle life in the fleet. A recruit must pass Battle Stations in order to go on to graduation.

Successful physical conditioning is based on a set of tenets. The tenets set the tone for the whole program and play an important part in executing an effective program. Following these tenets will lead to better decisions regarding constructing and conducting each recruit's conditioning program.

Tenet 1: Have a Master Plan. Recruits are grouped into divisions during Basic Training. Thus, the master plan must be constructed for the group as well as for the individual recruit. The master plan sets goals and shows how the recruit will achieve those goals. A master plan looks at the total picture and the future. For the recruit, the master plan is 8 weeks of physical conditioning.

Tenet 2: Set Reasonable Goals. Goals should be a challenge, but they must also be reasonably attainable. Recruits' goals should be based on what they can do now. The first PRT indicates a lot about the initial physical fitness level of the recruit. From this performance time, reasonable goals can be established toward an improved performance time. A goal of 12 minutes on the first PRT 1.5-mile run is reasonable for all recruits, and a goal of 11 minutes is reasonable for many recruits. A goal such as breaking 10 minutes in the 1.5-mile run may be a real challenge, but it is one that a good training program can deliver. A person moves by steps, not by leaps. The purpose of setting reasonable goals is to help lead the recruit in a gradual progression toward larger goals.

Tenet 3: Base the Plan on Specific Events. For a recruit to improve in any event, the physical ability specific to that event must be developed. An example of this tenet is preparing

recruits for Battle Stations. In Battle Stations, recruits are required to handle a number of shipboard scenarios related to handling an approaching hurricane, performing shipboard firefighting, performing a search and rescue for injured shipmates, and defending the ship in response to small arms attack.

Tenet 4: Follow the Progressive Approach to Training. Physical conditioning conducted at the same intensity every day can lead to fatigue, boredom, loss of interest in training, and musculoskeletal injuries. However, continued increases in physical fitness and reductions in the risk of injury can be attained using a hard/easy training schedule. In progressive training, one day of high-intensity, strenuous physical work is followed by a day of low-intensity, easy physical work. This form of training can be viewed as a day of overload and a day of restoration. The exercised muscles may need between 36 and 48 hours to recover from very strenuous exercise. Every RDC must avoid the temptation to train recruits ever harder. Human nature tells us that if so much work results in so much progress, twice as much work should yield twice the progress. However, the recruit may break down under heavy training loads. The use of very heavy training will lead to diminished returns.

This manual outlines the recommended recruit physical training schedule for 8-weeks of Naval recruit training in Chapter 2. Chapter 3 provides a background into concepts and principles of physical conditioning. The final Chapter discusses physical conditioning principles applied to Great Lakes.

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Chapter 2. Recommended Recruit Physical Training Schedule

The RTCs requirements included (a) incorporation of Battle Stations into the final evaluation of recruits, (b) a directive instructing RDCs to assess the physical rigor of the training program to determine if the program is "too easy," and (c) a directive instructing RDCs to ensure that the physical conditioning program for women is sufficient to prepare them for successful completion of the final PRT and Battle Stations. The recommended revised physical training program for recruit training is provided in Figure 1. This revised program was based on previous recommendations (Appendix A) and the actual training schedule as of July 1998 (Appendix B).

WEEK	Day 1	Day 2	Day 3	Day 4	Day 5	Saturday	Sunday
P			PT-Zero				
1	Strength & Condition (Module 5)	Low Aerobic (Module 2)	Strength & Condition (Module 5)	Moderate Aerobic (Module 3)		Low Aerobic (Module 2)	
2	PREP (Module 1); Confidence Course [2 hr]	Strength & Condition (Module 5)	Low Aerobic (Module 2)	Strength & Condition (Module 5)	Moderate Aerobic (Module 3)	Strength & Condition (Module 5)	
3	Strength & Condition (Module 5)	Moderate Aerobic (Module 3)	Strength & Condition (Module 5)	Moderate Aerobic (Module 3)	Strength & Condition (Module 5)	Moderate Aerobic (Module 3)	
4	Moderate Aerobic (Module 3)	Strength & Condition (Module 5)	PREP (Module 1)	PRT #1 [2 hr]	Low Aerobic (Module 2)	Strength & Condition (Module 5)	
5	High Aerobic (Module 4)	Strength & Condition (Module 5)	Low Aerobic (Module 2)	Strength & Condition (Module 5)	High Aerobic (Module 4)	Strength & Condition (Module 5)	
6	Moderate Aerobic (Module 3)	Strength & Condition (Module 5)	High Aerobic (Module 4)	Strength & Condition (Module 5)	Low Aerobic (Module 2); Confidence Course [2 hr]	Captain's Cup [5 hr]	
7	PREP (Module 1)	Final PRT [2 hr]	PREP (Module 1)	Battle Stations	Low Aerobic (Module 2)	Strength & Condition (Module 5)	
8	Moderate Aerobic (Module 3)	Strength & Condition (Module 5)	Moderate Aerobic (Module 3)		Graduation		

Figure 1. Recommended Revised Physical Training Program.

This chapter includes recommended training modules that were used to build a physical training schedule for RTC recruits. Five modules have been developed: (1) PRT Readiness Exercise Period (PREP), (2) Low Aerobic Endurance Conditioning, (3) Moderate Aerobic Endurance Conditioning, (4) High Aerobic Endurance Conditioning, and (5) Muscle Strength and Power Conditioning. Per OPNAVINST 6110.1E, *Physical Readiness Program*, each exercise session should consist of aerobic exercise, a strength and flexibility component, and warm-up and cool-down periods. With that in mind, each recommended training module is an exercise session which includes a 5- to 10-minute warm-up, 5-minute cool-down, and flexibility conditioning. Each module contains exercise routines that are time efficient, easy to perform without any special equipment, and are modifiable for indoor, outdoor, or shipboard environments. Illustrations and written descriptions of proper technique for the warm-up, muscle strength and conditioning, and cool-down / flexibility exercises are presented in Appendix C.

Exercise Intensity

Target heart rates for aerobic training are calculated per OPNAVINST 6110.1E, *Physical Readiness Program*. The target heart rate is a gauge of work intensity performed during exercise that shows the body is receiving a heart-healthy workout. The following are target heart rates computed for 20-year-old recruits for PREP, low, moderate, and high intensity aerobic workouts as outlined in Modules 1, 2, 3, and 4, respectively. The numbers in the following table represent the appropriate range for heart rate counted over a 10-second period.

Module	Heart Rate Range Beats per Minute (10-second count)
1. PREP	100-120 (17-20)
2. Low aerobic	120-140 (20-23)
3. Moderate aerobic	140-160 (23-27)
4. High aerobic	160-175 (27-29)

The maximum predicted heart rate is calculated by subtracting one's age from 220. The maximum predicted heart rate for a 20-year-old recruit is 200 beats per minute. Using target heart rate as a guide for intensity is better than using pace per mile as a guide for intensity

because it allows the more-fit recruit to train at an individual pace. A definition of a more-fit recruit is one who can run a given pace at a lower heart rate than another recruit.

While exercise heart rate can be determined by counting the pulse on the radial artery at the wrist or the cerebral artery at the neck, this method is not always accurate. Missing a single pulse beat over a 10-second period can greatly underestimate the actual heart rate. However, the level of physical strain or intensity of the exercise work load can be estimated from an individual's subjective ratings of perceived exertion (RPE) using a numerical scale (Borg).

RPE is directly related to heart rate, rate of energy expenditure, depth and rate of breathing, and level of mechanical power output. Heart rate (in beats per minute), RPE values (scaled to heart rate), and words verbalizing the corresponding RPE/work load-intensity relationship are shown in the preceding table. Since RPE is related to exercise intensity, it can be used to monitor the intensity of low, moderate, and high intensity aerobic endurance training sessions. RPE is a tool to standardize physical training which can be used for everyone regardless of gender or age.

Module	Heart Rate (beats per minute)	RPE value	Intensity Rating
Resting	60	6	
	70	7	Very, very light
Walking	80	8	
	90	9	Very light
1. PREP	100	10	
	110	11	Fairly light
2. Low aerobic	120	12	
	130	13	Somewhat hard
3. Moderate aerobic	140	14	
	150	15	Hard
4. High aerobic	160	16	
	170	17	Very hard
Maximal exercise	180	18	
	190	19	Very, very hard
	200	20	

General guidelines for placement of the modules throughout the 8-week RTC schedule include (a) 3 sessions per week of aerobic training on nonconsecutive days, with a maximum of 2 sessions per week of hard aerobic exercise; (b) 2 to 3 sessions per week of muscle strength and endurance training on nonconsecutive days; (c) PREP workouts during scheduled physical training in the 1 to 2 days preceding or after PRTs; and (d) 6 total scheduled exercise sessions, including aerobic, strength, and PREP workouts, per week.

The muscle strength and endurance component of the program uses calisthenics since they do not require any additional equipment. Although these exercises provide an adequate total body workout, the number of safe and effective calisthenics is limited. In addition, these exercises provide primarily muscle endurance training and little strength training for the physically fit recruit who can perform multiple repetitions without fatigue. Training variety, enjoyment, and potential benefit can be enhanced with the addition of some relatively inexpensive equipment, such as dumbbells and resistance bands.

The modules are designed to physically condition the average RTC recruit (“Good” to “Satisfactory” baseline fitness). To challenge the more physically fit recruits, the runs can be performed in ability groups. Likewise, the more-fit recruits can perform more sets and repetitions of the calisthenics. Effort should be made to maintain the intensity levels as recommended for each recruit. Higher than recommended intensities likely will result in increased training-related injuries. The schedule is designed to maximize fitness gains during recruit training and minimize training-related musculoskeletal injuries. It is also designed to promote long-term exercise practices among Navy recruits.

Module 1: PRT Readiness Exercise Period (PREP)

1. Warm-up (10 to 15 minutes): (see Appendix C)

Jumping jacks (Figures 1A & 1B), arm circles (Figure 2), brisk walking, knee lifts (Figure 3), and leg stretches

2. PREP

a. Outdoors or field house (30 to 40 minutes):

(1) 1.0- to 1.5-mile slow jog. Heart rate range: 100-120 beats per minute; 17-20 beats per 10-second count. RPE value: 10-11. Intensity rating: Fairly light

b. Barracks or field house (10 to 20 minutes) (choose/combine any of the following):

(1) high stepping (low impact), (2) brisk walking, (3) super circuit course,* or (4) low-impact aerobics

* High stepping or brisk walking for 30 to 60 seconds, alternating with 30 to 60 seconds of calisthenics.

3. Cool-Down and Flexibility Training (10 to 15 minutes)

The cool-down routine should use the same muscle groups in a similar activity pattern as the preceding exercise session. The intensity should gradually decrease from that of the exercise session. For example, to cool down from a running session, recruits could jog for a few minutes then briskly walk. Once the cardiovascular system has returned to a near-resting state (in 5 to 10 minutes), the cool down should conclude with a total body stretching routine. All stretches should be performed in a static manner, without bouncing, and held for 10 to 20 seconds.

Stretches (see Appendix C):

- a. Neck stretch (neck) (Figure 17)
 - b. Rounded shoulder reach (upper back, shoulders) (Figure 18)
 - c. Chest, shoulder, and biceps stretch (Figure 19)
 - d. Back scratch stretch (triceps) (Figure 20)
 - e. Overhead side bends (trunk) (Figure 21)
 - f. Spinal twist (lower back, iliotibial band) (Figure 22)
 - g. Seated butterfly stretch (groin muscles) (Figure 23)
 - h. Standing hip flexor stretch (hip flexors, calf muscles) (Figure 24)
 - i. Supine hamstring stretch (hamstrings) (Figure 25)
 - j. Prone quadriceps stretch (quadriceps, shin muscles) (Figure 26)
 - k. Straight and bent-knee standing calf stretch (calf muscles) (Figures 27A & 27B)
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Module 2: Low Aerobic Endurance Conditioning

1. Warm-up (10 to 15 minutes) (see Appendix C)

Jumping jacks (Figures 1A & 1B), arm circles (Figure 2), brisk walking, knee lifts (Figure 3), and leg stretches

2. Low Aerobic Endurance Conditioning Routine (20 to 40 minutes)

- a. Outdoors or field house: 1.5- to 2.0-mile run. Heart rate range: 120-140 beats per minute; 20-23 beats per 10-second count. RPE value: 12-13. Intensity rating: Somewhat hard
- b. Barracks or field house (choose/combine any of the following): (1) high stepping (low impact), (2) brisk walking, (3) super circuit course,* or (4) low-impact aerobics

* High stepping or brisk walking for 30 to 60 seconds, alternating with 30 to 60 seconds of calisthenics.

3. Cool-Down and Flexibility Training (10 to 15 minutes)

The cool-down routine should use the same muscle groups in a similar activity pattern as the preceding exercise session. The intensity should gradually decrease from that of the exercise session. For example, to cool down from a running session, recruits could jog for a few minutes then briskly walk. Once the cardiovascular system has returned to a near-resting state (in 5 to 10 minutes), the cool down should conclude with a total body stretching routine. All stretches should be performed in a static manner, without bouncing, and held for 10 to 20 seconds.

Stretches (see Appendix C):

- a. Neck stretch (neck) (Figure 17)
 - b. Rounded shoulder reach (upper back, shoulders) (Figure 18)
 - c. Chest, shoulder, and biceps stretch (Figure 19)
 - d. Back scratch stretch (triceps) (Figure 20)
 - e. Overhead side bends (trunk) (Figure 21)
 - f. Spinal twist (lower back, iliotibial band) (Figure 22)
 - g. Seated butterfly stretch (groin muscles) (Figure 23)
 - h. Standing hip flexor stretch (hip flexors, calf muscles) (Figure 24)
 - i. Supine hamstring stretch (hamstrings) (Figure 25)
 - j. Prone quadriceps stretch (quadriceps, shin muscles) (Figure 26)
 - k. Straight and bent-knee standing calf stretch (calf muscles) (Figures 27A & 27B)
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Module 3: Moderate Aerobic Endurance Conditioning

1. Warm-up (10 to 15 minutes) (see Appendix C)

Jumping jacks (Figures 1A & 1B), arm circles (Figure 2), brisk walking, knee lifts (Figure 3), and leg stretches

2. Moderate Aerobic Endurance Conditioning Routine (20 to 40 minutes)

- a. Outdoors or field house: 2.0- to 2.5-mile run. Heart rate range: 140-160 beats per minute; 23-27 beats per 10-second count. RPE value: 14-15. Rating intensity: Hard
- b. Barracks or field house (choose/combine any of the following): (1) high stepping (low impact), (2) brisk walking, (3) super circuit course,* or (4) low-impact aerobics

* High stepping or brisk walking for 30 to 60 seconds, alternating with 30 to 60 seconds of calisthenics.

3. Cool-Down and Flexibility Training (10 to 15 minutes)

The cool-down routine should use the same muscle groups in a similar activity pattern as the preceding exercise session. The intensity should gradually decrease from that of the exercise session. For example, to cool down from a running session, recruits could jog for a few minutes then briskly walk. Once the cardiovascular system has returned to a near-resting state (in 5 to 10 minutes), the cool down should conclude with a total body stretching routine. All stretches should be performed in a static manner, without bouncing, and held for 10 to 20 seconds.

Stretches (see Appendix C):

- a. Neck stretch (neck) (Figure 17)
- b. Rounded shoulder reach (upper back, shoulders) (Figure 18)
- c. Chest, shoulder, and biceps stretch (Figure 19)
- d. Back scratch stretch (triceps) (Figure 20)
- e. Overhead side bends (trunk) (Figure 21)
- f. Spinal twist (lower back, iliotibial band) (Figure 22)
- g. Seated butterfly stretch (groin muscles) (Figure 23)
- h. Standing hip flexor stretch (hip flexors, calf muscles) (Figure 24)
- i. Supine hamstring stretch (hamstrings) (Figure 25)
- j. Prone quadriceps stretch (quadriceps, shin muscles) (Figure 26)
- k. Straight and bent-knee standing calf stretch (calf muscles) (Figures 27A & 27B)

Module 4: High Aerobic Endurance Conditioning

1. Warm-up (10 to 15 minutes) (see Appendix C)

Jumping jacks (Figures 1A & 1B), arm circles (Figure 2), brisk walking, knee lifts (Figure 3), and leg stretches

2. High Aerobic Endurance Conditioning Routine (20 to 40 minutes)

- a. Outdoors or field house: 2.0- to 3.0-mile run. Heart rate range: 160-175 beats per minute; 27-29 beats per 10-second count. RPE value: 16-17. Intensity rating: Very hard
- b. Barracks or field house (choose/combine any of the following): (1) high stepping (low impact), (2) brisk walking, (3) super circuit course,* or (4) low-impact aerobics

* High stepping or brisk walking for 30 to 60 seconds, alternating with 30 to 60 seconds of calisthenics.

3. Cool-Down and Flexibility Training (10 to 15 minutes)

The cool-down routine should use the same muscle groups in a similar activity pattern as the preceding exercise session. The intensity should gradually decrease from that of the exercise session. For example, to cool down from a running session, recruits could jog for a few minutes then briskly walk. Once the cardiovascular system has returned to a near-resting state (in 5 to 10 minutes), the cool down should conclude with a total body stretching routine. All stretches should be performed in a static manner, without bouncing, and held for 10 to 20 seconds.

Stretches (see Appendix C):

- a. Neck stretch (neck) (Figure 17)
 - b. Rounded shoulder reach (upper back, shoulders) (Figure 18)
 - c. Chest, shoulder, and biceps stretch (Figure 19)
 - d. Back scratch stretch (triceps) (Figure 20)
 - e. Overhead side bends (trunk) (Figure 21)
 - f. Spinal twist (lower back, iliotibial band) (Figure 22)
 - g. Seated butterfly stretch (groin muscles) (Figure 23)
 - h. Standing hip flexor stretch (hip flexors, calf muscles) (Figure 24)
 - i. Supine hamstring stretch (hamstrings) (Figure 25)
 - j. Prone quadriceps stretch (quadriceps, shin muscles) (Figure 26)
 - k. Straight and bent-knee standing calf stretch (calf muscles) (Figures 27A & 27B)
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Module 5: Muscle Strength and Power Conditioning

1. Warm-up (10 to 15 minutes): (see Appendix C)

Jumping jacks (Figures 1A & 1B), arm circles (Figure 2), brisk walking, knee lifts (Figure 3), and leg stretches

2. Muscle Strength and Power Conditioning Routine (20 to 40 minutes)

Group A exercises will target all of the body's major muscle groups. These should be performed, in the order listed, during each scheduled strength and conditioning session. Group B exercises may be added for variety and to increase the training stimulus. The number of exercise sets and repetitions performed should gradually progress from Week 1 to Week 8. For example, Week 1: 2 sets of 20 to 30 repetitions of each exercise; Week 8: 2 to 3 sets of 30 to 50 repetitions

of each exercise. Recruits should feel temporary muscle fatigue at the completion of each set. Rest periods between sets should be approximately 2 minutes.

Group A (see Appendix C):

1. Push-ups (chest and shoulders) (Figures 4A & 4B)*
2. Squats (hamstrings, quadriceps, gluteus) (Figures 5A & 5B)
3. Toe raises (shin muscles) (Figure 6)
4. Heel raises (calf muscles) (Figure 7)
5. Narrow grip push-ups (chest, triceps) (Figures 8A & 8B)*
6. Front lying chest lifts (back) (Figure 9)
7. Trunk curls (abdominals) (Figures 10A & 10B)

Group B (see Appendix C):

1. Lunges (hamstrings, quadriceps, gluteus) (Figure 11)
2. Outer thigh lifts (hip abductors) (Figures 12A & 12B)
3. Inner thigh lifts (hip adductors) (Figures 13A & 13B)
4. Front lying leg lifts (gluteus) (Figure 14)
5. Twisting trunk curls (abdominals, obliques) (Figure 15A & 15B)
6. Hip rollers (abdominals) (Figure 16)

*Recruits who cannot maintain proper technique should perform modified push-ups (knees on the deck).

3. Cool-Down and Flexibility Training (10 to 15 minutes)

The cool-down routine should use the same muscle groups in a similar activity pattern as the preceding exercise session. The intensity should gradually decrease from that of the exercise session. For example, to cool down from a running session, recruits could jog for a few minutes then briskly walk. Once the cardiovascular system has returned to a near-resting state (in 5 to 10 minutes), the cool down should conclude with a total body stretching routine. All stretches should be performed in a static manner, without bouncing, and held for 10 to 20 seconds.

Stretches (see Appendix C):

- a. Neck stretch (neck) (Figure 17)
- b. Rounded shoulder reach (upper back, shoulders) (Figure 18)
- c. Chest, shoulder, and biceps stretch (Figure 19)
- d. Back scratch stretch (triceps) (Figure 20)

- e. Overhead side bends (trunk) (Figure 21)
- f. Spinal twist (lower back, iliotibial band) (Figure 22)
- g. Seated butterfly stretch (groin muscles) (Figure 23)
- h. Standing hip flexor stretch (hip flexors, calf muscles) (Figure 24)
- i. Supine hamstring stretch (hamstrings) (Figure 25)
- j. Prone quadriceps stretch (quadriceps, shin muscles) (Figure 26)
- k. Straight and bent-knee standing calf stretch (calf muscles) (Figures 27A & 27B)

Chapter 3. Concepts and Principles of Physical Conditioning

Physiological Principles of Conditioning

Physical Fitness. For the purpose of boot camp, physical fitness is defined as the ability to run fast and demonstrate endurance, be flexible, lift heavy objects or weights, carry heavy loads, and perform a large number of push-ups, chin-ups, and sit-ups. Thus, a physically fit individual is defined as someone who has a high anaerobic and aerobic endurance capacity, joint flexibility, is physically strong, and is efficient in skill execution.

Energy Continuum. The body and muscles expend energy to perform physical work. The energy for work comes from three different systems. The first energy system is already stored in the muscle and doesn't require oxygen to perform work. This energy is called the immediate energy system and powers short bursts of activity for up to three seconds.

The second energy system is called anaerobic metabolism because oxygen is not required for muscle force production. Work conducted using anaerobic metabolism is called anaerobic work. Examples of anaerobic work are weightlifting, sprinting (100 to 200 meters), swinging a baseball bat, using hand tools, and performing any activity characterized by a high and rapid rate of power output.

The third energy system is called aerobic metabolism because oxygen must be continuously supplied to the muscles to keep them working. Work conducted using this system of energy is called aerobic work. Examples of aerobic work are continuous activities which use large muscle groups such as long-distance marching, running, cycling, and swimming.

The use of anaerobic and aerobic energy in the execution of physical work can be viewed as an energy continuum, with work requiring anaerobic energy at one end and work requiring aerobic energy at the other end. The energy continuum can be visualized by applying the concept to running. A high intensity work session lasting up to 20 seconds in duration is performed anaerobically, while lower intensity work lasting many minutes or hours is primarily performed aerobically. However, many forms of work fall in the middle range of the energy continuum and require the use of both anaerobic and aerobic energy. Many of the skills, tasks, and operations found in Battle Stations require both anaerobic and aerobic energy sources.

Principle of Overload. Increases in physical fitness occur through application of the Overload Principle. The Overload Principle is defined as a level of stress, load, force, or intensity

of activity above or greater than that which the body or muscle is normally adapted to handle. In this regard, the “overload” stress level is beneficial in that the muscle or system is able to attain a new and higher level of functional capacity. Application of the Overload Principle throughout the course of a physical conditioning program should be gradual. This will promote a higher level of physical fitness without development of significant musculoskeletal injury. As a general rule, weekly physical training loads should not be increased more than 10 to 15%.

Principle of Specificity. The Specificity of Training Principle is an application of the Overload Principle. In this principle, each type of training imposes specific whole-body and individual muscle demands that are directly related to the exercise routines comprising the training program. Subsequently, the whole-body and muscle responses and adaptations are specific to the demands imposed by the training program. For example, run, cycle, and swim training all increase endurance capacity. However, each of these types of training has its own unique demands and adaptations, which are directly related and specific to the muscle activity patterns used during training. With regard to strength and power development, training the arms leads to increases in arm strength, while training the legs leads to increases in leg strength. However, in neither case do the strength gains transfer to the other muscle groups. In addition, improvement in aerobic endurance will not transfer to improvement in muscular strength, and increases in muscular strength will have little effect on increases in aerobic endurance capacity. Thus, training should be directed toward the specific endurance, strength, and skill requirements of the exercise activity in question. The specificity of training principle has special meaning when training recruits for Battle Stations. Since each Battle Station has its own unique goals and objectives, training recruits to meet the demands of these scenarios will require the RDCs to develop training exercises containing endurance, strength, and skill components unique to each station.

Principle of Reversibility. During Basic Training, recruits travel (i.e., walking, jogging, drilling) an average of 25 miles per week. However, after graduation, the new sailor frequently becomes detrained because of a reduction in training stimulus and volume. Thus, physical conditioning must be continued on a regular basis to maintain the gains in physical fitness acquired during Basic Training. The amount of training required to maintain physical fitness is slightly lower than that needed to improve fitness. When physical training is stopped completely, deconditioning sets in and all gains in endurance capacity and/or muscular strength and power

return to pretraining levels. Significant reductions in physical fitness occur within 2 weeks of cessation of physical training.

Components of Physical Fitness.

Physical fitness has four basic components: (a) aerobic endurance, (b) anaerobic energy production and speed, (c) strength and power, and (d) flexibility. The foundation of physical fitness is aerobic endurance. Aerobic endurance should precede training for the other components of physical fitness. Development of anaerobic and speed conditioning should follow aerobic endurance physical training. Flexibility conditioning requires slow, static stretching of muscles and tendons.

Aerobic Endurance Conditioning. The first step in a balanced physical conditioning program is building endurance, or aerobic capacity. This process entails developing cardiorespiratory functional capacity which will increase the recruits' ability to complete the PRT 1.5-mile run faster. During Basic Training, endurance training comes primarily from walking, jogging, and running. The factors governing increases in endurance capacity include (a) duration of exercise or distance traveled per training session; (b) the intensity, speed, or pace of the activity; and (c) the frequency or number of training sessions per week.

Developing aerobic endurance capacity requires 2 to 4 training sessions per week. This training activity can come in the form of brisk walking, marching, or jogging, at low to moderate intensity for 20 to 30 minutes. For most recruits, moderate-intensity exercise will produce a "target range" heart rate from 130 to 150 beats per minute and a perceived exertion of "moderately hard."

Developing aerobic capacity depends on the distance and duration of the activity and not on running speed. As long as recruits get their heart rate into the target range, running a given distance will produce approximately the same aerobic training effect and the same caloric expenditure, whether it is run at a 10-minute-mile pace or a 6-minute-mile pace. Running at a slower pace will increase aerobic capacity and minimize injury risk. In general, a minimum of 4 to 6 weeks is recommended for a healthy young adult to build an aerobic base.

For beginning runners, the risk of musculoskeletal injuries is significantly increased when training frequency is greater than 3 sessions per week, or running duration is longer than 30 minutes per workout. The gains in aerobic capacity with longer or more-frequent running

sessions are minimal compared with the increased risk of injury. Running speed or intensity, and difficulty of terrain are factors that produce the greatest risk for musculoskeletal injuries.

Controlling the distance and frequency of the training sessions minimizes the number of running injuries. High-intensity training, such as sprints and high-speed intervals of walk/run cycles, should be reserved for those individuals who have already built a firm aerobic base and are well-adapted to running.

Increases in endurance capacity are rapidly lost after the cessation of routine aerobic exercise. Significant reductions in aerobic capacity occur within 2 weeks, with many individuals returning to near baseline in just a few months. Although the minimal level of exercise required to maintain cardiovascular fitness is not known, some studies suggest that for sedentary individuals as little as 20 minutes of aerobic exercise, performed 2 times per week, may be adequate as long as the relative training intensity is sufficient and remains constant.

Modified interval training can be used to expand an individual's aerobic base and increase one's capacity to run faster for longer periods of time. Interval training is performed by alternating 2- to 4-minute intervals of moderately low-intensity running (40 to 60% of maximum effort; perceived exertion of "moderately easy") with 2- to 3-minute intervals of moderately high-intensity running (70 to 80% of maximum effort; perceived exertion of "moderately hard") for 4 to 6 repetitions. This form of training will improve the recruits' average running speed in preparation for PRTs. To minimize injury risk, this type of training should be performed on nonconsecutive days and no more than 2 times per week.

Stride length varies among recruits. Formation runs are more likely to cause injury than individual runs by forcing alterations in natural stride length and reducing biomechanical efficiency.

Anaerobic and Speed Conditioning. The ability to rapidly generate a high level of power output is the critical factor underlying anaerobic capacity and the ability to move at a high rate of speed. Anaerobic capacity and speed are critical to elite performance in every event. While speed comes from the contractile quality of the muscles, the efficiency of movement comes from specific training, which, in turn, leads to greater speed. Although the basic quality of speed (reaction time) is largely inherited, it can be improved through a strength training routine to increase muscle mass followed by task specific training.

In anaerobic and speed conditioning, individual energy output is very high and the overload stress to the body is great. As a result, sustained anaerobic or speed conditioning can lead to exhaustion, fatigue, and musculoskeletal injuries. Thus, anaerobic and speed conditioning should be limited to short intervals of intense work and longer periods of rest time between strenuous workouts. For example, up to one minute of high intensity exercise should have at least a three minute rest period; a 1:3 ratio.

Strength and Power Conditioning. Muscle conditioning consists of both muscle strength and endurance training. For general fitness, strength conditioning should occur 2 to 3 times per week on nonconsecutive days for specific muscle groups. An exercise is considered primarily strength training if it produces temporary fatigue in the targeted muscle group within 60 to 90 seconds (generally, 6 to 10 repetitions at relatively high resistance). For muscle endurance training, multiple repetitions (more than 20) are performed using lower resistance. A gradual progression in the resistance used and in the number of repetitions and sets performed will maximize both safety and training benefits. Everyone should perform a warm-up set of 15 to 20 repetitions at relatively low resistance. For novice weightlifters, it is safer to begin with lighter weights and more repetitions. To start, most fitness experts recommend 1 to 3 sets of 8 to 12 repetitions to temporarily fatigue the targeted muscle group. If only 1 set is performed, it should be 15 to 20 repetitions with light weights.

Studies have shown that 1 set of 15 to 20 repetitions, at a resistance high enough to produce temporary muscle fatigue, performed 2 days a week, will stimulate significant strength gains in the muscle group exercised. Although training more frequently with more sets of exercises produces greater muscle strength, the additional strength gains are usually small and increase the risk for injury.

Calisthenics are exercises that use body weight to produce resistance. They can be used for both muscle strength and endurance training. For the poorly fit recruit who can only perform a minimal number of repetitions, the exercises are primarily a form of strength training. For more-fit recruits who can perform multiple repetitions, calisthenics are primarily a form of muscle endurance training.

Resistance training generally affects the body part trained and the range of motion through which the muscles are exercised. Strength gains occur mostly in the exercised muscles through the range of motion performed plus or minus an additional 10 to 20 degrees. For

example, if an individual performs knee extension exercises through a range of 60 to 90 degrees, the knee extensors will become stronger within a range of motion of approximately 40 to 110 degrees. Therefore, all major muscle groups should be exercised through a full, normal range of motion. There are a few exceptions to this rule, which are discussed in the following paragraph. Extremes of motion should be avoided due to increased injury risk.

Exercise technique is important for both training effectiveness and injury prevention. All exercises should be performed in a slow, controlled manner within a limited, joint-specific range of motion. Some experts recommend at least 6 seconds per repetition. The individual should not rock or sway and should focus on the muscle group being exercised. Proper body position will maximize training benefits and reduce injury risk. Low back pain and knee injuries are common exercise-related problems. Any exercises that result in low back extension beyond 15 to 20 degrees or full flexion at the waist with straight knees, place increased stress on the lower spine and should be avoided. Likewise, knee flexion beyond 90 degrees is not recommended since it significantly increases the forces generated behind the patella (kneecap).

Super circuit training combines muscle conditioning and cardiovascular exercises to produce both a strength and aerobic training stimulus. In a super circuit course, resistance exercises are alternated with 30- to 60-second bouts of moderate-intensity aerobic exercise with minimal to no rest periods. The resistance exercises can be performed using free weights, weight machines, or calisthenics. Examples of moderate-intensity aerobic exercise include brisk walking, high stepping, and jogging. For maximum training effectiveness and safety, the resistance exercises should be sequenced such that large muscle groups are exercised first and consecutive exercises target different muscle groups. Since circuit training produces fewer aerobic fitness gains than continuous aerobic exercise, it should not be used as the only form of aerobic training.

Cessation of resistance training will result in a progressive loss of muscular strength over a few months' time. Studies suggest that strength can be maintained with only one weightlifting session per week as long as intensity is maintained.

Flexibility Training. Flexibility refers to joint range of motion. Limited flexibility is the result of tight muscles, tendons, and/or joint capsules. The resulting reduction in normal joint range of motion is believed to contribute to reduced performance and increased injuries. The

purpose of flexibility training is to produce a permanent stretch in the muscles and connective tissues to allow full joint range of motion.

Ideally, stretching exercises should occur before and after any strenuous physical training. Since muscles are most flexible when they are warm, a 10- to 15-minute warm-up session should always precede any stretching exercises to minimize the risk of tearing tissues. Appropriate warm-up activities include brisk walking, slow jogging, and light calisthenics. The pre-exercise stretching should be activity-specific. For example, if the exercise session will include mostly running, the lower extremity muscles should be stretched. Flexibility training is most effective in producing long-term results when performed after the exercise session, when the muscles are the warmest. Flexibility is very joint-specific. Therefore, post-exercise stretching should target all major muscle groups. The recommended frequency is 3 to 5 times per week.

For maximum safety and effectiveness, stretches should be (a) slow and static (no bouncing); (b) held for 10 to 20 seconds; (c) taken to the point of tightness, not pain; and (d) performed with proper biomechanical technique (see Appendix C). For a more detailed review of calisthenics and flexibility exercises see Meyer et al. "Expert Panel Review of Naval Special Warfare Calisthenics: Sports Medicine Conference Summary".

Optimizing Training Programs.

Balanced Training. Balanced training is defined as a physical conditioning program that includes four major elements: (a) immediate energy system training for the development of "explosive" power, (b) anaerobic energy system training including strength training to increase muscle size and capacity for high force and high work output, (c) aerobic energy system training for the development of cardiovascular function and oxygen delivery for long duration activity, and (d) flexibility training for development of increased joint range of motion. Execution of a balanced physical conditioning program increases the physical fitness of each recruit.

Periodization Training. A major concern for the RDC is conducting the balanced training program within the confines of the master training schedule. This can be accomplished using the concept of periodization training. The strength of periodization training is that it points the training effort toward a major goal.

In periodization training, the conditioning program is divided into periods of time or cycles, usually weeks at a time. A macrocycle is a complete training cycle and contains three

periods: preparation, competition, and recovery. Each cycle has a different training emphasis and workload. The purpose of the preparation period is to prepare the recruit for the next, more advanced period of training or competition. This approach helps the recruit achieve the optimal training effect from each phase of training and peak at the ideal moment. Peaking of competition is always followed by a recovery period.

Basic Training can be viewed as a macrocycle. This macrocycle can be subdivided into smaller periods (e.g., the 3 weeks prior to and the 4 weeks after Service Week). Applying the concept of periodization to Basic Training suggests that the first 3 weeks of Basic Training can be viewed as a preparation period. During this time the recruits are prepared for their first PRT and for the Confidence Course, which occurs during the competitive period of Week 4. This is followed by a recovery period of rest and light-to-moderate conditioning during the Service Week. The second cycle starts after Service Week and includes another cycle of preparation, albeit at a higher training load for the final PRT and Battle Stations.

Cornerstones of Physical Conditioning

There are three cornerstones to successful physical conditioning: moderation, consistency, and rest.

Moderation. All physical conditioning should be done in moderation. This means not going to extremes. Extra-hard bouts of training can lead to serious injuries, forcing the recruit away from training. Withdrawing recruits from Basic Training is expensive and results in extra work for the RDC.

Consistency. One way to avoid erratic physical training is to train at a reasonable and consistent level every day. This does not mean using the same training load each day. When a recruit trains consistently, the body has more time to adapt to the stress of training, allowing it to ease its way to higher levels of fitness. If a few days of training are missed, the body may lose tone and endurance. However, a day or two of extra-hard training will not make up for the loss in training. In fact, the recruit may overstress the body, resulting in an injury. Extra physical strain does more than simply tire the body; it can lead to injury. The recruit who trains daily at a moderate level will outperform the equally physically fit recruit who trains extremely hard at times and skips training at other times. Consistency has another reward for the recruit. As

physical conditioning continues, a solid fitness base develops. The longer the time used to develop the base, the less effect an interruption has on training.

Rest. Rest is the third, and perhaps the most important, cornerstone of training because it is during rest that the muscles rebuild and adapt to the debilitating stress of physical training. Exercise is catabolic, a destructive phase of metabolism, and rest is anabolic, a constructive phase of metabolism.

Daily rest: Since recruits are required to go to sleep late and awaken early each morning, adequate rest is the training rule recruits are least likely to follow. Recruits feeling tired or weak should not try to complete hard training sessions. Instead, they should perform very light training sessions. The RDC should be aware of how much sleep recruits are getting. Recruits in training need more rest and sleep, but the constraints of boot camp usually do not allow adequate time.

Rest between hard exercise sessions: Recruits need 2 to 3 days for adequate recovery from very strenuous exercise. "High aerobic endurance conditioning", Module 4 (see Chapter 3), and hard "Muscle strength and power conditioning", Module 5 (see Chapter 3), should not be performed back-to-back. RDC's must avoid the temptation to train recruits hard 2 days in a row. The frequent use of very heavy training will lead to diminished returns.

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Chapter 4. Physical Conditioning Principles Applied to Recruit Training Center, Great Lakes

Prevention of Musculoskeletal Injuries

Musculoskeletal injuries are common in recruits. During Basic Training, about 18% of males become injured, while about 38% of females develop injury. These injuries occur primarily to the feet, ankles, knees, and legs, and, when performing upper-body work, to the hands, arms, shoulders, and back. However, using a gradual increase in exercise stress can reduce injury rates.

A number of factors lead to increased injury rates: (a) poor physical fitness prior to the start of training, (b) higher weekly training volume and mileage, (c) abrupt or rapid increases in training volume or intensity, (d) improper exercise technique, and (e) a prior musculoskeletal injury that has not fully recovered.

Principles of Injury Prevention. Injuries can be prevented and/or minimized by (a) gradual progression in training volume and intensity (particularly for the individual who was previously sedentary or had poor physical fitness), (b) proper warm-up and cool-down procedures applied before and after all vigorous exercise training sessions, (c) proper exercise technique, (d) relative rest days after high-intensity endurance or strength training to allow adequate time for tissue recovery and adaptation, and (e) proper management of injuries.

Warm-up Activities. Warm-up activities should precede each training session. Warm-up activities increase the temperature and elasticity of the muscles and connective tissues, redistribute blood flow to large muscles groups, and increase the activity of the sympathetic nervous system, thus preparing the individual for the training session. Warm-up activities, when properly done, reduce the risk of musculoskeletal injury. Warm-up activities should include stretching and low-intensity exercises related to the training activity, last a minimum of 10 to 15 minutes in duration, and use large muscle groups. For example, 10 to 15 minutes of brisk walking, gradually increasing in pace, would be an appropriate warm-up for a running workout.

Cool-Down Activities. Each training session should conclude with cool-down activities. Cool-down activities allow the body to gradually return to the resting state. Cool-down activities should last a minimum of 10 to 15 minutes, use the same large muscle groups as used in the training session, gradually decrease in intensity, and finish with stretching exercises of the major

muscle groups used in the training session. For example, an appropriate cool-down session for a running workout would be a slow jog, gradually decreasing in pace to a brisk walk, followed by a total body flexibility routine.

Environmental Conditions. Much of Basic Training involves adapting to the weather and environmental conditions. At times, the weather can interfere with or delay training. The biggest problems arise when recruits are required to train in hot and cold environmental conditions.

Heat. The principal problem with training in the hot weather is heat stress or hyperthermia. In this condition, body temperatures rise to dangerously high levels. Prolonged elevation of body core temperatures over 103°F can lead to death. This scenario is all too common. During the first week of Basic Training, the new recruit, deconditioned and unaccustomed to working in hot weather, participates in a rigorous training session or military drill. During the session, the individual's sweat rate is at first able to cool the body. However, during the course of the exercise, the level of sweating becomes reduced, thereby limiting the body's ability to cool itself. As a result, internal body temperature increases to 103°F or above. At this point, the recruit is in the early stages of heat exhaustion. As a consequence, the recruit may not feel like drinking or eating. The recruit then takes a shower but is not in long enough to completely cool down. Eventually, the recruit goes to bed. However, the problem has only just begun. While the recruit is exhausted and has no problem falling asleep, his or her internal body temperature can remain elevated throughout the night. The next morning the recruit arises, goes out for another training session or military drill resulting in unconsciousness or, in rare instances, death. An autopsy reveals massive damage to the brain, heart, kidney, and other internal organs, as a result of the prolonged elevation of body temperature. However, it is important to understand this type of death is 100% preventable through early recognition of the signs and symptoms of heat illness and the application of procedures that reduce body temperature, restore body fluids, and allow for rest and recovery.

Hyperthermia is particularly a problem when hot air temperatures are combined with high humidity. The elevated humidity prevents the recruit's sweat from evaporating quickly, which, in turn, limits the body's ability to cool. If the humidity is high, heat strain can appear in the exercising recruit at an air temperature of 70°F (22°C). Even with low humidity, temperatures above 80°F (27°C) can increase the risk of heat illness.

Recognizing the signs and symptoms of heat stress can save a life. The symptoms of heat strain include headaches, dizziness, sudden tiring or weakness, a pounding sensation in the head, tingling or goose bump sensations across the body, or the cessation of sweating.

Five levels of heat strain are cramps, exhaustion, syncope (fainting), dehydration, and collapse or heatstroke. Muscle cramps can result from excessive loss of salt through sweating. Taking salt tablets may increase the problem unless enough fluid is taken at the same time. In most cases, recruits eat enough salt with meals to avoid this problem.

Heat exhaustion causes fainting or collapse as the body tries to deal with the increase in body temperature. It can result from loss of fluids and electrolytes. Heatstroke is most noticeable when sweating stops. Failure to cool the body can eventually lead to brain damage, coma, and even death.

Sweating and evaporation of sweat from the skin are the methods the body uses to cope with heat and humidity. The level of humidity is important because the greater the amount of water in the air, the lower the amount of sweat that evaporates from the skin. The RDC can address heat strain and hyperthermia by answering three questions: "Is the recruit sweating?" and, if so, "Is the sweat evaporating?" and "Is the recruit getting enough water or fluids?"

In warm or humid training conditions, fluid intake is extremely important. The most easily and quickly absorbed fluid is water. Allow the recruit to take short breaks to drink water or other fluids. Waiting until the training session is completed to drink fluids is extremely dangerous and does not help an athlete adapt to heat.

Becoming heat acclimatized is best done in natural environmental conditions. To work in the heat, the simplest way is to train in the heat. However, heat training can be accomplished any time of the year by raising the body core temperature and sweating even in cold climates by wearing sweat suits that dissipate moisture but spare body heat loss. It is raising the core temperature that is the stimulus for heat acclimatization. A recruit who is acclimatized to the heat can train harder and longer, and perform more work, in cooler conditions. Adapting to heat takes about 10 to 14 days and is best accomplished when exercise or physical work is conducted in conjunction with heat exposure resulting in increased body core temperature. For better results the recruit should perform longer, easier work sessions, take frequent short breaks, and drink plenty of fluids.

Cold. Cold weather creates its own training problems. In cold weather, recruits must dress for protection from cold air and wind. Modern fabrics and layering of clothing can create air layers between garments that will buffer the effects of cold air. The most important parts of the body needing protection are the extremities (feet and toes, hands and fingers). Thermal socks or layers of socks are needed for the feet, while mittens or gloves are used for the hands. The material should absorb sweat so the body can cool itself properly within the warm bundles of protective gear. A cap that can cover the ears, or added earmuffs, helps protect the head. In extreme climates, the recruit may wear a ski mask to protect the face from frostbite.

A sunny, cold day or a windy day can create special problems. A warmly dressed recruit may overheat if the sun is out and the air is calm. A recruit also can suffer from heat strain if body heat generated from physical work is not allowed to dissipate. The same effect as calm air is possible while marching in the direction of a tailwind.

On cold, windy days an out-and-back training run is the best choice for a training session. Begin the training run with the recruits facing the wind. Then have the recruits return with their backs to the wind so as they become warm they can safely remove clothing layers. If the process were reversed, the recruits could overheat early, then chill and tire rapidly when finishing their run into the wind.

RDCs and recruits should be aware of the effects of the wind-chill factor. A strong wind in cool conditions will create harsher conditions than expected. Strong winds heighten the impact and effect of cold air. Insisting on an outdoor run regardless of weather conditions is inappropriate. It may be far wiser to skip a session or train indoors than to risk injury or worse.

Physical Readiness Test Data and Branch Medical Clinic Data (1997 - 1998)

The Naval Health Research Center analyzed data provided by RTC Great Lakes and determined the following information:

1. Baseline aerobic fitness levels of recruits arriving at RTC Great Lakes are based on the initial PRT (PT1) 1.5-mile run time test which was administered during training week 4, training day 4 on the old schedule. The score categories are per OPNAVINST 6110.1E, *Physical Readiness Program*.

Males: The average aerobic fitness level classification of male recruits arriving at RTC is "Good". However, twenty-five percent (25%) of the all male recruits are classified as "Satisfactory" or slower. The average 1.5-mile run time for male recruits (all age groups combined) arriving at RTC is 10:48, which corresponds to 84 points.

Males by age group	% of incoming recruits	Average PT1 run time	Score	Score category
17 yr - 19 yr	54%	10:45	84 points	Good
20 yr - 29 yr	44%	10:52	83 points	Good
30 yr - 39 yr	2% *	11:15	81 points	Excellent

*The sample size is considered too small to provide meaningful results.

Females: The average aerobic fitness level classification of female recruits arriving at RTC is "Good". However, twenty-nine percent (29%) of the all female recruits are classified as "Satisfactory" or slower. The average 1.5-mile run time for female recruits (all age groups combined) arriving at RTC is 13:28, which corresponds to 68 points.

Females by age group	% of incoming recruits	Average PT1 run time	Score	Score category
17 yr - 19 yr	56%	13:29	68 points	Good
20 yr - 29 yr	42%	13:27	68 points	Good
30 yr - 39 yr	2% *	13:45	66 points	Excellent

*The sample size is considered too small to provide meaningful results.

2. Aerobic fitness levels of recruits graduating from RTC Great Lakes are based on the final PRT (PT2) 1.5-mile run time test which was administered during training week 7, training day 4 on the old schedule. These classifications are per OPNAVINST 6110.1E.

Males: The average aerobic fitness level classification of male recruits graduating from RTC is "Excellent". Four percent (4%) of the male recruits are classified as "Satisfactory" or slower. The average 1.5-mile run time for male recruits (all age groups combined) graduating from RTC is 10:19, which corresponds to 87 points.

Males by age group	% of graduating recruits	Average PT2 run time	Score	Score category
17 yr - 19 yr	33%	10:10	88 points	Good
20 yr - 29 yr	63%	10:23	86 points	Excellent
30 yr - 39 yr	4% *	10:42	84 points	Excellent

*sample size is considered too small to provide meaningful results.

Females: The average aerobic fitness level classification of female recruits graduating from RTC is “Excellent”. Five percent (5%) of the female recruits are classified as “Satisfactory” or slower. The average 1.5-mile run time for female recruits (all age groups combined) graduating from RTC is 12:22, which corresponds to 74 points.

Females by age group	% of graduating recruits	Average PT2 run time	Score	Score category
17 yr - 19 yr	38%	12:23	74 points	Excellent
20 yr - 29 yr	58%	12:21	74 points	Excellent
30 yr - 39 yr	4% *	12:15	75 points	Excellent

*sample size is considered too small to provide meaningful results.

3. Navy Physical Readiness Test Score Percentiles by Gender, Age Group, Fitness Category, and initial PRT (PT1) and final PRT (PT2).

Males 17 yr - 19 yr	1.5-Mile	PT1	PT2
Fitness Category	Run Times	Category %/Cumulative %	Category %/Cumulative %
Outstanding	9:00 and faster	2.2% / 2.2%	2.8% / 2.8%
Excellent	9:01 - 9:45	11.4% / 13.6%	24.4% / 27.2%
Good	9:46 - 11:00	51.2% / 64.8%	63.6% / 90.8%
Satisfactory	11:01 - 12:45	32.5% / 97.3%	9.0% / 99.8%
Slower than ...	12:45	2.7% / 100.0%	0.2% / 100.0%

Males 20 yr - 29 yr	1.5-Mile	PT1	PT2
Fitness Category	Run Times	Category %/Cumulative %	Category %/Cumulative %
Outstanding	9:15 and faster	4.1% / 4.1%	7.5% / 7.5%
Excellent	9:16 - 10:30	32.5% / 36.6%	49.5% / 57.0%
Good	10:31 - 12:00	11.8% / 88.2%	41.4% / 98.4%
Satisfactory	12:01 - 13:45	11.3% / 99.5%	1.4% / 99.8%
Slower than ...	13:45	0.5% / 100.0%	0.2% / 100.0%

Females 17 yr - 19 yr	1.5-Mile	PT1	PT2
Fitness Category	Run Times	Category %/Cumulative %	Category %/Cumulative %
Outstanding	11:30 and faster	3.9% / 3.9%	17.0% / 17.0%
Excellent	11:31 - 12:30	17.1% / 21.0%	31.1% / 48.1%
Good	12:31 - 13:30	35.6% / 56.6%	41.5% / 89.6%
Satisfactory	13:31 - 15:00	32.2% / 88.8%	8.5% / 98.1%
Slower than ...	15:00	11.2% / 100.0%	1.9% / 100.0%

Females 20 yr - 29 yr	1.5-Mile	PT1	PT2
Fitness Category	Run Times	Category %/Cumulative %	Category %/Cumulative %
Outstanding	11:30 and faster	5.7% / 5.7%	22.4% / 22.4%
Excellent	11:31 - 13:15	39.1% / 44.8%	57.1% / 79.5%
Good	13:16 - 14:15	31.8% / 76.6%	17.4% / 96.9%
Satisfactory	14:16 - 15:45	18.7% / 95.3%	2.5% / 99.4%
Slower than ...	15:45	4.7% / 100.0%	0.6% / 100.0%

4. Incidental movement time is defined as the time recruits have scheduled to spend on their feet. While this time is not intended to be physical training, it contributes to an exercise effect and fatigue. While the time a recruit has scheduled for transit and drill/pass-and-review does not exactly translate to miles, it is estimated the distance is between 20 and 25 miles per week. The activity durations during training are graphically represented in Appendix B.

5. Branch Medical Clinic data from June 1997 through May 1998:

Type of injury	Rate per 1,000 for all recruits	Rate per 1,000 for male recruits	Rate per 1,000 for female recruits
Musculoskeletal	213	180	380
Stress fracture	2.95	1.72	8.36

Guidelines for the RTC Physical Training Program

The RTCs requirements included (a) incorporation of Battle Stations into the final evaluation of recruits, (b) a directive instructing RDCs to assess the physical rigor of the training program to determine if the program is “too easy,” and (c) a directive instructing RDCs to ensure that the physical conditioning program for women is sufficient to prepare them for successful completion of the final PRT and Battle Stations. It was not within NHRC's purview to make recommendations to change Battle Stations, and NHRC was required to incorporate six physical training sessions per week. Therefore, these new requirements necessitate modification and revision of existing physical conditioning guidelines (see Chapter 2).

1. Given the relatively poor baseline fitness level of the average recruit, the physical conditioning program should start with low- to moderate-intensity exercise and focus on building an aerobic and muscular strength and endurance base.

2. The incidental movement distances constitute a high training volume for the average recruit. If this movement is performed as brisk walking or marching for bouts of 10 or more continuous minutes, it will produce a significant aerobic training stimulus for most of the recruits.

3. The final PRT 1.5-mile run times (described above) showed significant improvements in aerobic capacity for both male and female trainees. This suggests that the movement miles, in conjunction with the aerobic physical training performed during boot camp, produce an adequate training stimulus.

4. Given the amount of movement mileage, 2 scheduled running sessions per week of 1.0 to 1.5 miles, at a moderate-intensity pace, likely will provide adequate aerobic conditioning as well as preparation for the final PRT run. Additional high-impact aerobic exercise is not recommended due to the increased risk of overuse injuries to the lower extremities. All running should occur on nonconsecutive days to allow for tissue recovery and relative rest.

5. Weather and field house unavailability may restrict some training sessions to the barracks. The hard floors of the standard military barracks provide minimal shock absorption. High-impact activities, such as running in place and high-impact aerobics, should be modified to low-impact techniques, such as running on grass or stationary cycling, to minimize injury risk to the lower extremities.

6. In general, the recruits' physical training program (see Appedndix C) should include (a) 3 sessions per week of aerobic training for 30 to 40 minutes on nonconsecutive days, (b) 2 to 3 sessions per week of a balanced muscle strength (relatively high weight, low repetitions) and muscle endurance (relatively low weight, high repetitions) program on nonconsecutive days, (c) 4 to 5 sessions per week of a total body flexibility routine, and (d) warm-up and cool-down sessions before and after each exercise session, respectively.

Influences on Physical Conditioning

Tobacco. Smoking or the use of any tobacco product by recruits is not permitted anywhere aboard the RTC base, indoors or outdoors. As stated in SECNAVINST 5100.13B, Navy and Marine Corps Tobacco Policy, the health consequences of tobacco use in all its forms and exposure to environmental tobacco smoke by nonsmokers clearly have been documented. Tobacco use is considered the chief preventable cause of premature death and disease in the United States. Tobacco use and environmental tobacco smoke exposure have an adverse impact upon the health and readiness of the naval forces. Smokeless tobacco is not a safe alternative to smoking. Smoking tobacco can adversely affect respiratory capacity and the ability to perform aerobic exercise.

An effective program that supports abstinence and discourages use of tobacco products should be created by personal example and by command climate. Ensure that staff members at initial training programs do not use tobacco when in the presence of students or recruits. RDCs should lead by example.

Alcohol. While alcohol consumption does not appear to be an issue during recruit training, OPNAVINST 5350.4B, Alcohol and Drug Abuse Prevention and Control instruction, states that there should be education, awareness, and deterrence at all levels.

Alcohol has no apparent effect on athletic performance when consumed in small amounts, but it can have a substantial detrimental effect when consumed in large doses. Alcohol is not an ergogenic aid.

Nutrition. OPNAVINST 6110.1E, *Physical Readiness Program*, provides guidelines for basic nutrition. It recommends eating caloric-controlled, low-fat, high-fiber meals, and offering a nutrition education program using NAVPERS 15602A, the Navy Nutrition and Weight Control Self-Study Guide. Nutritional considerations are of paramount importance since the recruits place considerable demands on their bodies during the course of physical training.

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Appendix A

Original Recommended Alpha and Bravo Physical Training Schedules - September 1996

Before Battle Stations

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Original Recommended Physical Training Schedule For RTC Recruits - September 1996
Before Battle Stations

Alpha Schedule

DAY/ WEEK	1/MON	2/TUE	3/WED	4/THUR	5/FRI	6/SAT	7/SUN
P							LITE
1		Aerobic		Strength & Condition	Aerobic		Strength & Condition
2		Confidence Course [2 hr]	Aerobic	Strength & Condition	Strength & Condition		Aerobic
3	LITE	Strength & Condition	Aerobic		Strength & Condition		Aerobic
4		Strength & Condition	LITE	PRT #1 [2 hr]		Strength & Condition	
5	SERVICE WEEK				Aerobic		Strength & Condition
6		Aerobic		Strength & Condition	Confidence Course [2 hr]	DC Olympics [5 hr]	Aerobic
7		Strength & Condition	LITE	Final PRT [2 hr]	Strength & Condition	Seamanship Olympics [5 hr]	
8	Aerobic	Strength & Condition	LITE	Graduation			

Original Recommended Physical Training Schedule For RTC Recruits - September 1996
Before Battle Stations

Bravo Schedule

DAY/ WEEK	1/MON	2/TUE	3/WED	4/THUR	5/FRI	6/SAT	7/SUN
P							LITE
1		Aerobic		Strength & Condition	Aerobic		Strength & Condition
2		Confidence Course [2 hr]	Aerobic		Strength & Condition		Aerobic
3	LITE	Strength & Condition	Aerobic		Strength & Condition		Aerobic
4		Strength & Condition	LITE	PRT #1 [2 hr]		Strength & Condition	
5	SERVICE WEEK				Aerobic		Strength & Condition
6		Aerobic		Strength & Condition	Confidence Course [2 hr]	DC Olympics [5 hr]	Aerobic
7	Strength & Condition		LITE	Final PRT [2 hr]	Strength & Condition	Seamanship Olympics [5 hr]	
8	Aerobic	Strength & Condition	LITE	Graduation			

Appendix B

Actual Alpha and Bravo Physical Training Schedules - July 1998

Battle Stations began 30 July 1997

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Actual Physical Training Schedule For RTC Recruits - July 1998

Battle Stations began 30 July 1997

Alpha Schedule

DAY/ WEEK	1/MON	2/TUE	3/WED	4/THUR	5/FRI	6/SAT	7/SUN
P							
1	Strength & Condition	Aerobic	Strength & Condition	Aerobic		Aerobic	
2	Aerobic; Confidence Course [2 hr]	Strength & Condition	Aerobic	Strength & Condition	Aerobic	Strength & Condition	
3	Strength & Condition	Aerobic	Strength & Condition	Aerobic	Strength & Condition	Aerobic	
4	Aerobic	Strength & Condition	LITE	PRT #1 [2 hr]	Aerobic	Strength & Condition	
5	SERVICE WEEK				Aerobic	Strength & Condition	
6	Aerobic	Strength & Condition	Aerobic	Strength & Condition	Aerobic; Confidence Course [2 hr]	Captain's Cup [5 hr]	
7	LITE	Final PRT [2 hr]	LITE	Battle Stations	Strength & Condition	Aerobic	
8	Aerobic	Strength & Condition	Aerobic		Graduation		

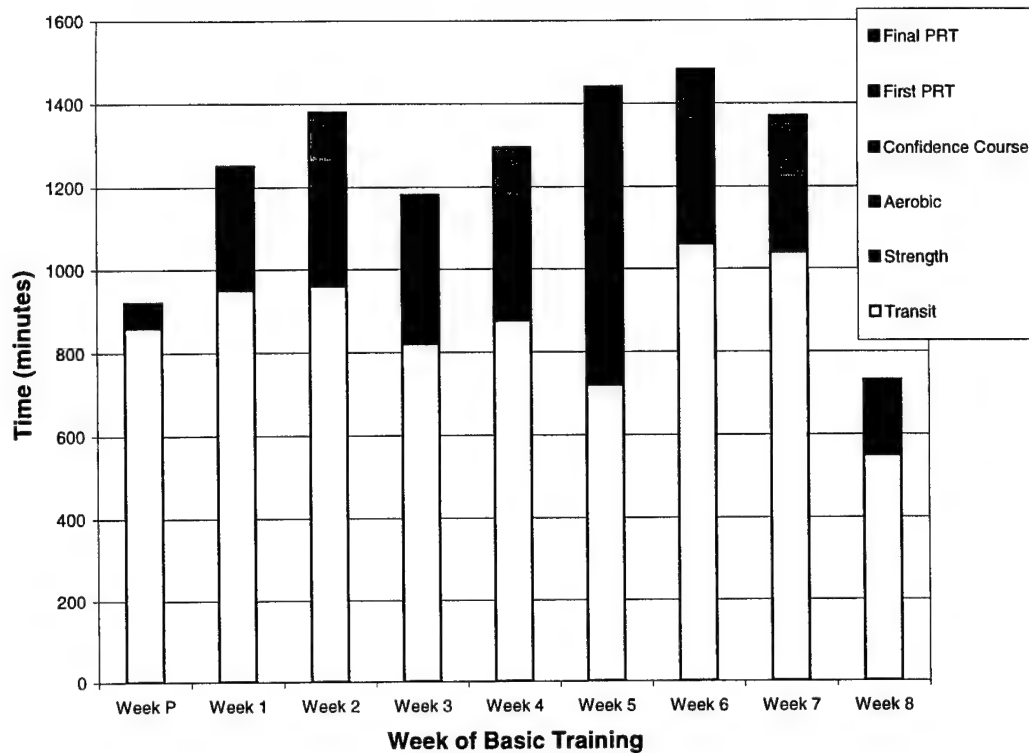
Actual Physical Training Schedule For RTC Recruits - July 1998

Battle Stations began 30 July 1997

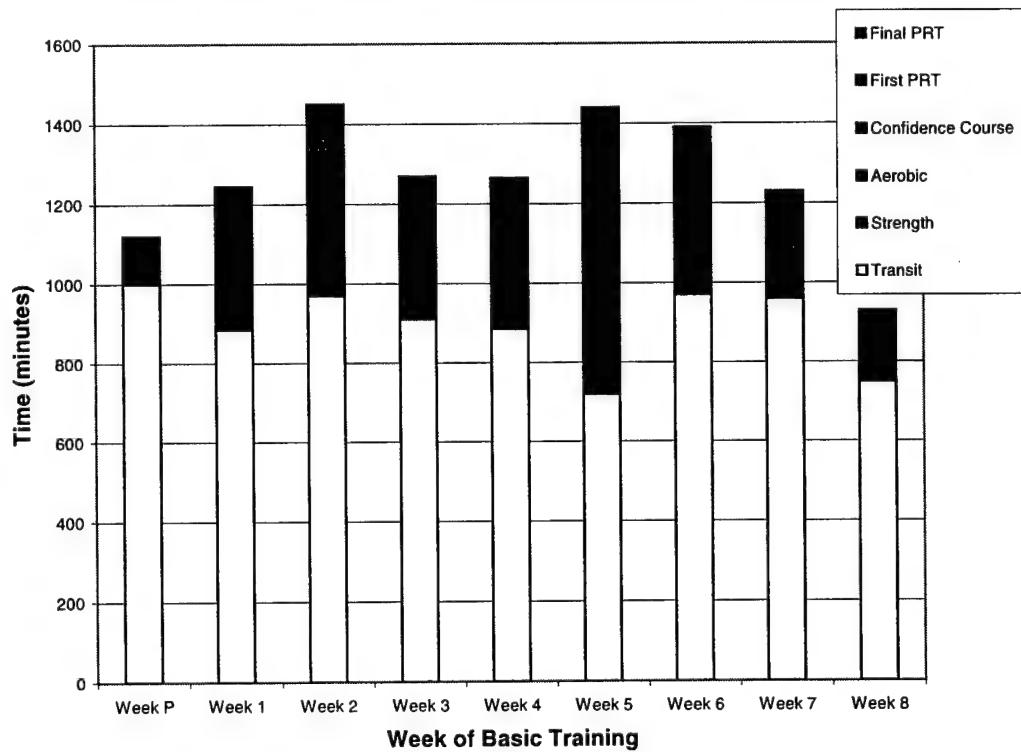
Bravo Schedule

DAY/ WEEK	1/MON	2/TUE	3/WED	4/THUR	5/FRI	6/SAT	7/SUN
P							
1	Strength & Condition	Aerobic	Strength & Condition	Aerobic	Strength & Condition	Aerobic	
2	Aerobic; Confidence Course [2 hr]	Strength & Condition	Aerobic	Strength & Condition	Aerobic	Strength & Condition	
3	Strength & Condition	Aerobic	Strength & Condition	Aerobic	Strength & Condition	Aerobic	
4	Aerobic	Strength & Condition	LITE	PRT #1 [2 hr]	Aerobic	Strength & Condition	
5	SERVICE WEEK				Aerobic	Strength & Condition	
6	Aerobic	Strength & Condition	Aerobic	Strength & Condition	Aerobic; Confidence Course [2 hr]	Captain's Cup [5 hr]	
7	LITE	Final PRT [2 hr]	LITE	Battle Stations	Strength & Condition	Aerobic	
8	Aerobic	Strength & Condition	Aerobic		Graduation		

Alpha Schedule Activity Durations During Basic Training - July 1998



Bravo Schedule Activity Durations During Basic Training - July 1998



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Appendix C

Warm-up, Muscle Strength and Conditioning, and Cool-down / Flexibility Exercises

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WARM-UP EXERCISES

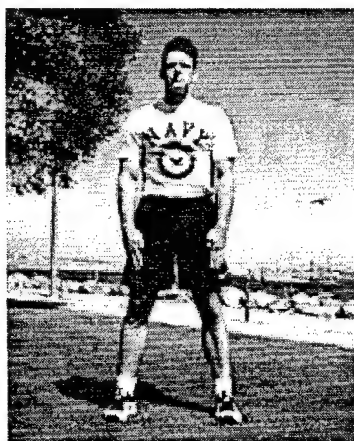


FIGURE 1A. Jumping Jacks

STARTING POSITION: Stand tall with feet together and hands placed at sides.

ACTION: Swing arms up and overhead, and spread feet apart in one movement. Return to starting position.

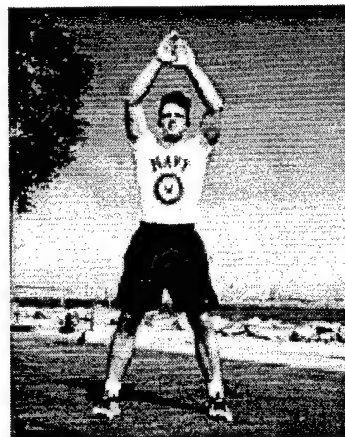


FIGURE 1B. Jumping Jacks cont.

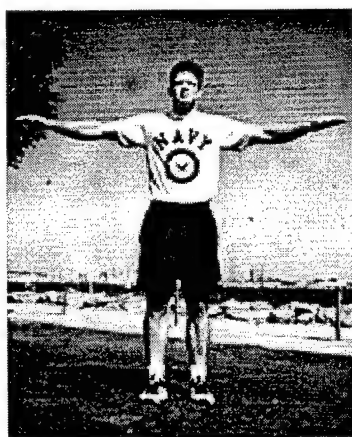


FIGURE 2. Arm Circles

STARTING POSITION: Stand tall with feet shoulder-width apart and arms extended to sides.

ACTION: Rotate arms forward in large circles. Relax neck, and do not shrug shoulders.

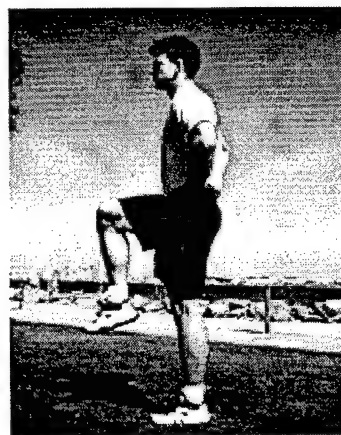


FIGURE 3. Knee Lifts

STARTING POSITION: Stand tall with feet shoulder-width apart and hands on waist.

ACTION: Slowly march in place, raising each knee to a 90-degree angle. Maintain tall posture

MUSCLE STRENGTH AND CONDITIONING EXERCISES - GROUP A



FIGURE 4A. Push-Ups

STARTING POSITION: Place hands on deck approximately shoulder-width apart and extend legs. Keep head in neutral position.

ACTION: Lower body by bending arms until elbows reach 90-degree angle. Return to starting position.



FIGURE 4B. Push-Ups Cont.

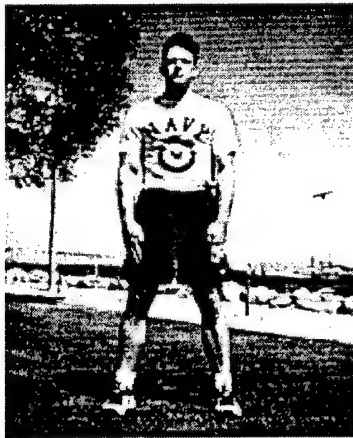


FIGURE 5A. Squats

STARTING POSITION: Stand tall with head up, back flat, and feet shoulder-width apart. Place hands on front of thighs.

ACTION: Lower body by bending knees until hands touch knees. Hold squat position for 8 to 10 seconds. Return to starting position.

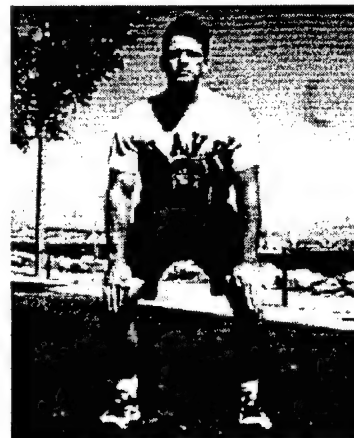


FIGURE 5B. Squats Cont.



FIGURE 6. Toe Raises

STARTING POSITION: Stand tall with feet placed approximately 8 inches apart. Place hands on waist or at sides.

ACTION: Alternately raise toes of one foot off floor, holding each contraction for 8 to 10 seconds. Return to starting position.

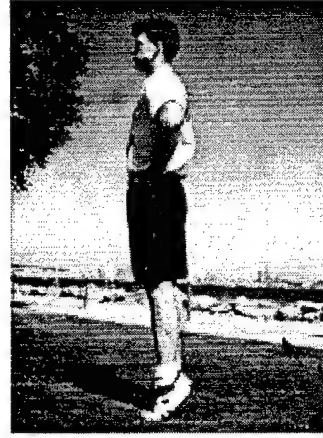


FIGURE 7. Heel Raises

STARTING POSITION: Stand tall with feet placed approximately 8 inches apart. Place hands on waist.

ACTION: Raise up to toes, lifting heels off deck. Hold raised-heel position for 8 to 10 seconds. Return to starting position.

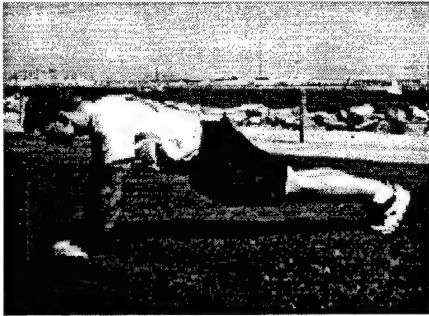


FIGURE 8A. Narrow Grip Push-Ups

STARTING POSITION: Place both hands on deck, forming a diamond with forefingers and thumbs. Extend legs, keeping head and neck in neutral position.

ACTION: Lower body by bending arms until elbows reach a 90-degree angle. Return to starting position.

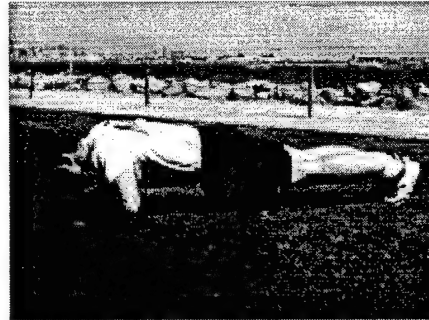


FIGURE 8B. Narrow Grip Push-Ups Cont.



FIGURE 9. Front Lying Chest Lifts

STARTING POSITION: Lie flat on deck, face down, legs extended. Bend elbows and place forearms and palms flat on deck at sides.

ACTION: Raise head and chest, tensing buttock and lower back muscles. Slowly return to starting position.



FIGURE 10A. Trunk Curls

STARTING POSITION: Lie on back with knees bent at 90-degree angle and hands placed behind head. Keep head and neck in neutral position.

ACTION: Raise head and neck until shoulder blades come off deck. Slowly return to starting position.



FIGURE 10B. Trunk Curls Cont.

MUSCLE STRENGTH AND CONDITIONING EXERCISES - GROUP B

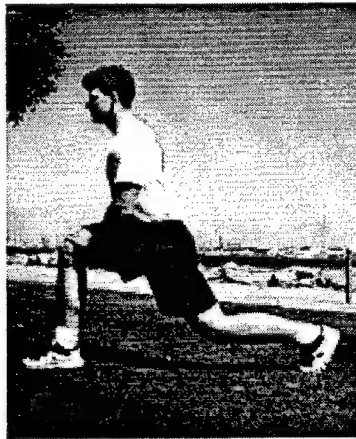


FIGURE 11. Lunges

STARTING POSITION: Stand tall with feet together
ACTION: Take a long step forward with one foot and bend back knee. Forward knee should not pass over forward foot. Return to starting position. Repeat on opposite side.



FIGURE 12A. Outer Thigh Lifts

STARTING POSITION: Lie on side with knees bent and thighs parallel.
ACTION: Lift top leg as high as possible and return to starting position. Repeat on opposite side.



FIGURE 12B. Outer Thigh Lifts Cont.



FIGURE 13A. Inner Thigh Lifts

STARTING POSITION: Lie on side with top leg bent over bottom leg.

ACTION: Lift bottom leg as high as possible. Return to starting position. Do not lean backward; stay on side. Repeat with opposite leg.



FIGURE 13B. Inner Thigh Lifts Cont.



FIGURE 14. Front Lying Leg Lifts

STARTING POSITION: Lie face down with head on hands.

ACTION: Lift one leg as high as possible. Return to starting position. Repeat with opposite leg.



FIGURE 15A. Twisting Trunk Curls

STARTING POSITION: Lie on back with one knee bent at 90-degree angle and opposite foot resting on bent knee.

ACTION: Slowly curl upper back off deck, bringing opposite elbow and knee together on alternate repetitions.



FIGURE 15B. Twisting Trunk Curls Cont.

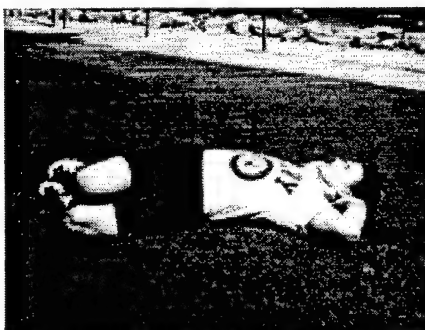


FIGURE 16. Hip Rollers

STARTING POSITION: Lie on back with knees bent at 90-degree angle and shoulders on deck. Place arms straight out to sides or hands behind head.

ACTION: Rotate knees to one side, keeping shoulders on ground. Return to starting position, then rotate knees to opposite side.

COOL-DOWN / FLEXIBILITY EXERCISES

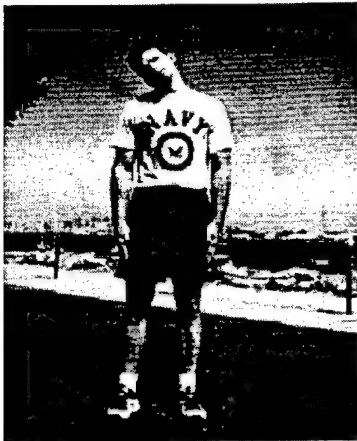


FIGURE 17. Neck Stretch

STARTING POSITION: Stand tall with arms placed at sides.

ACTION: Slowly lean head sideways toward shoulder and hold. Return to starting position. Repeat on opposite side.



FIGURE 18. Round Shoulder Reach

STARTING POSITION: Stand tall with fingers interlaced and palms turned outward.

ACTION: Extend arms outward and upward to shoulder level. Keep neck and shoulders in relaxed position.

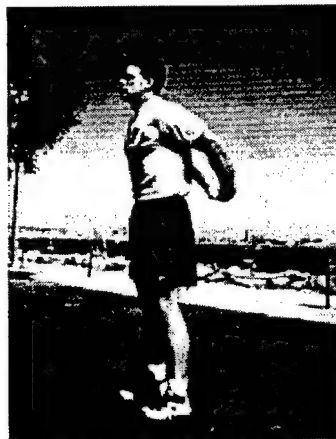


FIGURE 19. Chest, Shoulder, and Biceps Stretch

STARTING POSITION: Stand tall with fingers interlaced behind back.

ACTION: Slowly straighten and lift arms, turning elbows inward.

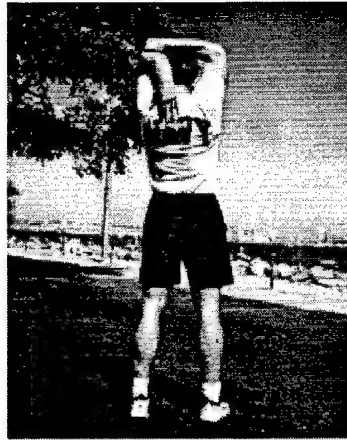


FIGURE 20. Back Scratch Stretch

STARTING POSITION: Stand tall. Place arms overhead. Hold elbow of one arm with the hand of the other arm.

ACTION: Gently pull elbow behind head and hold.



FIGURE 21. Overhead Side Bends

STARTING POSITION: Stand tall with arms extended overhead. Grasp right wrist with left hand. Cross left leg over right leg.

ACTION: Bend slowly to left side, using left arm to gently pull right arm over head and down to ground. Return to starting position. Repeat on opposite side.



FIGURE 22. Spinal Twist

STARTING POSITION: Sit with left leg bent inward. Bend right leg, cross right foot over, and rest it to outside of left thigh or left shin.

ACTION: Use left elbow to apply pressure to right knee. Turn head and torso to right. Return to starting position. Repeat on opposite side.

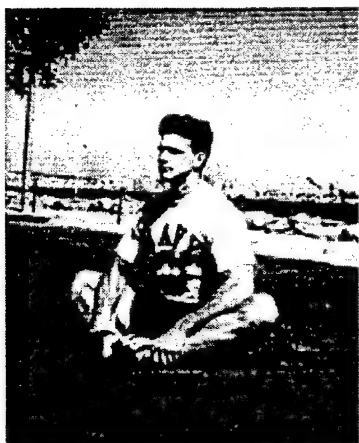


FIGURE 23. Seated Butterfly Stretch
STARTING POSITION: Sit tall with soles of feet together. Grasp ankles.
ACTION: Use elbows to apply pressure to inside of thighs. Keep back straight, and hold stretch. Return to starting position.



FIGURE 24. Standing Hip Flexor Stretch
STARTING POSITION: Take long step forward with one leg. Bend back knee slightly. Place hands on waist.
ACTION: Slowly tilt pelvis under, contracting buttock muscles. Return to starting position. Repeat on opposite side.



FIGURE 25. Supine Hamstring Stretch
STARTING POSITION: Lie on back. Extend one leg up, and grasp thigh.
ACTION: Gently pull thigh toward chest and hold. Return to starting position. Repeat on opposite side.

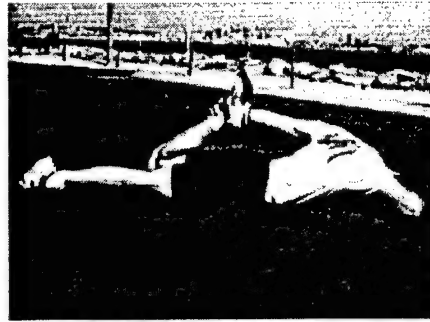
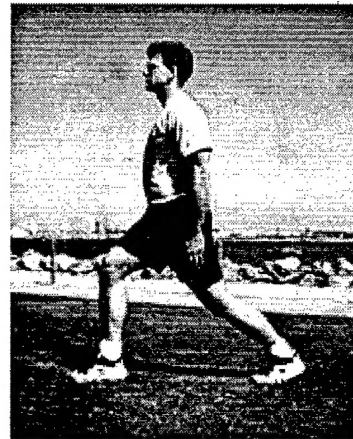


FIGURE 26. Prone Quadriceps Stretch
STARTING POSITION: Lie face down, resting head on one hand. Take opposite hand and grasp ankle of same side, bending knee.
ACTION: Gently pull ankle straight back toward buttocks and hold. Return to starting position. Repeat on opposite side.



FIGURES 27A & 27B. Straight and Bent-Knee Standing Calf Stretch

STARTING POSITION: Take a long step forward. Forward knee should not pass over forward foot. Place hands on waist or at sides.

ACTION: Straighten back knee, keeping back heel on ground, and hold. Keeping same position, bend back knee and hold. Return to starting position. Repeat on opposite side.

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REPORT DOCUMENTATION PAGE

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